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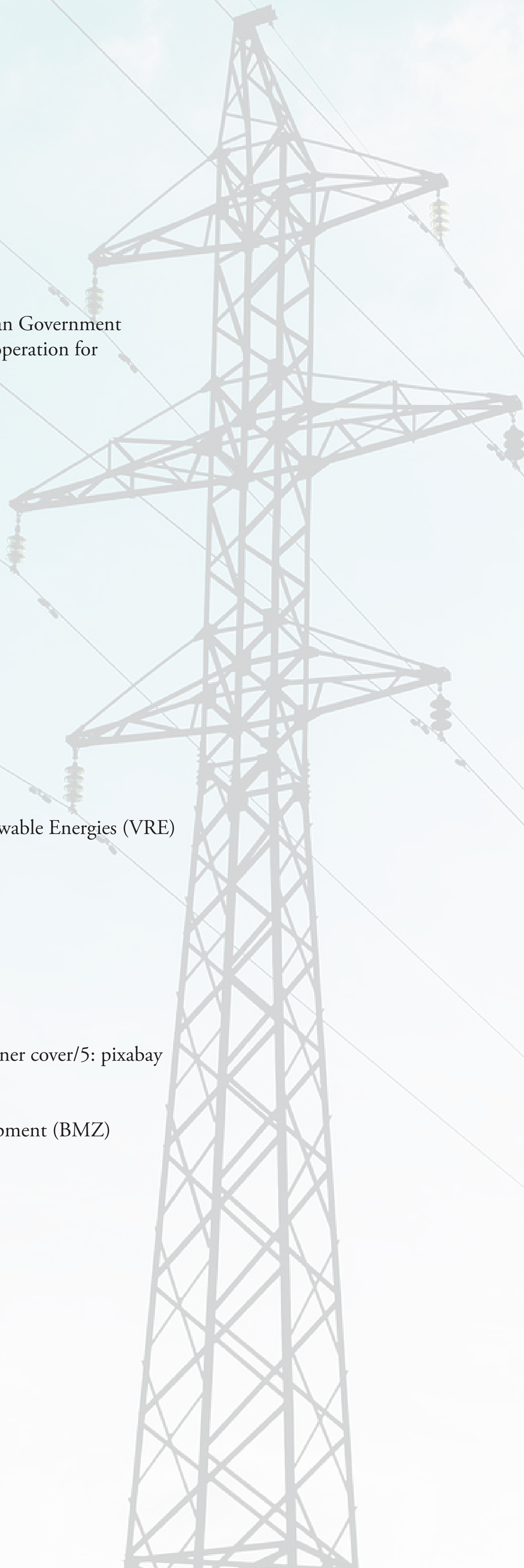
REPUBLIC OF KENYA
Ministry of Energy

Human Capacity Development Strategy for the Power System Readiness for Variable Renewable Energies (VRE) Project



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GLOSSARY

The following terms are frequently used in this publication. Within this context, the terms are used as described below:

Variable Renewable Energy	Renewable energy generators powered by wind, solar or tidal wave.
Variability	Sudden and often unexpected changes in power plant output due to the variation in energy input.
Uncertainty	Inability to consistently and accurately forecast the power output from variable renewable energy (VRE) sources.
Location constrained	VRE characteristic that limits its application to areas that have wind, solar, and tidal wave resources. VRE, unlike fossil fuel-based generators, requires siting to be in the same location as the fuel/energy source.
Flexibility	Ability of a power system to effectively balance variations in power generation and demand.
Baseload	The minimum level of demand on an electrical grid over a span of time, for example, one day or one week.
Peak demand	The maximum level of demand on an electrical grid over a span of time, for example, one day or one week.
Reserves	Extra generating capacity that is readily available and dispatchable by increasing the power output of generators that are already connected to the power system.
Ancillary services	Services supporting the proper operations of an electric power system including frequency regulation, reactive power regulations, active power reservation and others.
Merit order	Method of ranking available electricity generation resources (used by power system operators) based on price, with the least cost appearing first in an ascending order, together with the amount of energy that will be generated.
SimSEE	Electric Energy Systems Simulation.
Firm Capacity	This is the amount of energy available for production or transmission, which can be guaranteed to be available at a given time. Firm energy refers to the actual energy guaranteed to be available and is not dependent on external factors such as weather conditions.

ACRONYMS

AGC	Automatic Generation Control
CaDRE	Capacity Needs Diagnostics for Renewable Energies
CNA	Capacity Needs Assessment
EPC	Engineering Procurement and Construction
EPRA	Energy and Petroleum Regulatory Authority
FiT Tariff	Feed-in Tariff
GDC	Geothermal Development Company
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GT	Gas Turbine
HCD	Human Capacity Development
IPP	Independent Power Producers
IRENA	International Renewable Energy Agency
KenGen	Kenya Electricity Generating Company Limited
KETRACO	Kenya Electricity Transmission Company Limited
LCPDP	Least Cost Power Development Plan
LTWP	Lake Turkana Wind Project
MOE	Ministry of Energy
MTP	Medium Term Plan
NuPEA	Nuclear Power and Energy Agency
PPA	Power Purchase Agreement
REREC	Rural Electrification and Renewable Energy Corporation
Solar PV	Solar Photovoltaics
TOR	Terms of Reference
VRE	Variable Renewable Energy

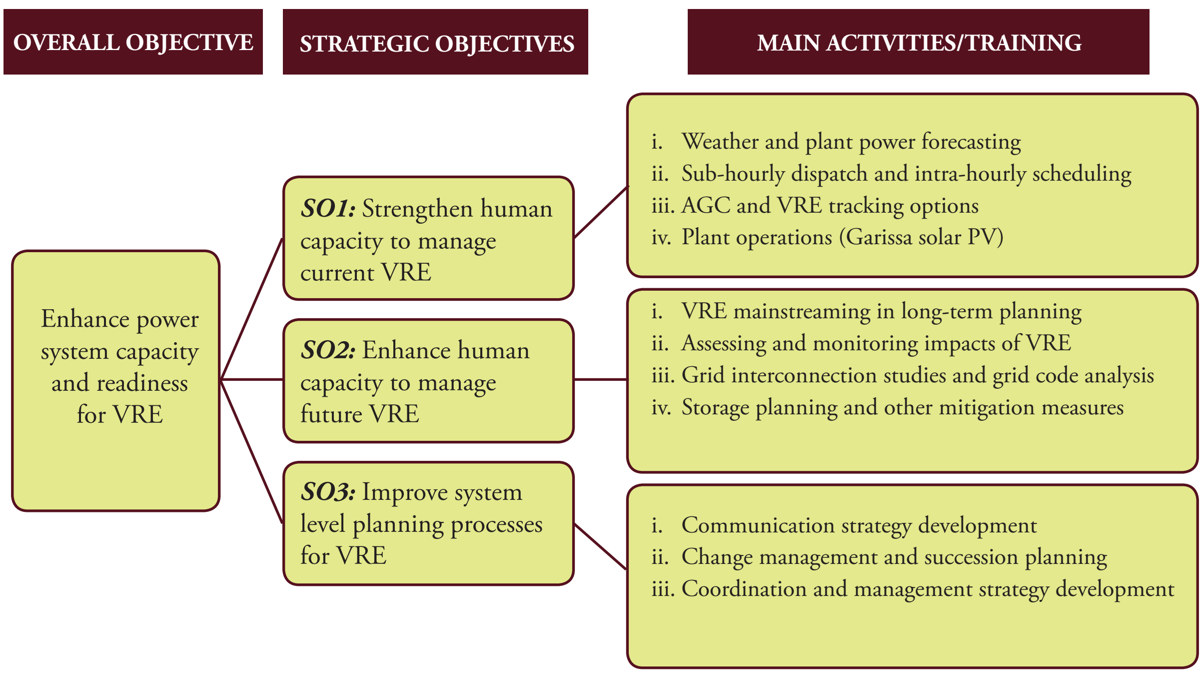
EXECUTIVE SUMMARY

As a component of the larger technical assistance project "Power system readiness for the integration of variable renewable energies (VRE)" that is being implemented by the Ministry of Energy and GIZ, this assignment entailed conducting a Capacity Needs Assessment (CNA) of stakeholders involved in VRE deployment in the energy sector and subsequently designing a Human Capacity Development strategy to bridge identified capacity gaps.

Meetings were held with 15 organisations (government agencies, development agencies, financial institutions, training institutions, and others); discussions held with over 40 persons in the sector; 31 responses received from the online self-assessment exercise and 4 case studies completed including Denmark, Morocco, Uruguay and USA (Ormat geothermal VRE tracking technology) as part of this assessment.

It was found that, in relative terms, Kenya's VRE development is unique in several aspects including: i) a very liberal approach to take-or-pay based PPAs for VRE with little to no countermeasures, ii) the largest single power generator in terms of installed capacity is based on VRE, iii) wind is treated as the baseload capacity (must-run) thereby making the electricity generation percentage from VRE in Kenya to be much more than the installed 15% share of VRE. The last aspect contrasts the experience in countries like Germany whose share of VRE is more than 40% of the total installed capacity, but the actual energy generated from VRE only accounts for about a quarter of the total electricity generated. From the Least Cost Power Development Plan (LCPDP), the proportion of VRE in Kenya is expected to rise to 26% by 2024.

This report is part 2 of 2 and outlines the human capacity development strategy building on the findings of the human capacity assessment report. This strategy breaks down the overall project objective of enhancing power system capacity and readiness for VRE into three strategic objectives namely; (i) strengthening human capacity to manage current VRE, (ii) enhance human capacity to manage future VRE and (iii) improving system-level planning processes for VRE, with the intent of establishing short, mid and long term remedial activities as indicated in the figure below.



To handle the current level of VRE integration to the power system, it is proposed that the capacity to forecast weather and VRE powerplant output is enhanced. This consequently feeds into the ability to conduct sub-hourly dispatch, intra-hourly scheduling and VRE power plant tracking which also requires to be enhanced at the national control centre. Additionally, the operations and maintenance of the 50 MW Garissa solar PV plant needs to be built into REREC'S current human capacity. These immediate steps are required in the short-term as indicated below.

To enhance the capacity to manage future VRE integration, it is proposed that the long-term energy planning and the governance of the implementation of the energy plans be enhanced. In line with this, the ability to monitor and assess the impacts of VRE as well as the ability to conduct grid interconnection studies requires development to support this objective. Furthermore, it is envisioned that future VRE integration will incorporate the use of peripheral technologies that mitigate variability such as storage. In this regard, it is proposed that the capacity to plan for and manage these technologies be enhanced.

To improve system-level planning process concerning VRE, we propose a restructuring of the existing planning process to ensure harmonisation across the LCPDP, VRE, GIS and FiT committees. Additionally, it is advised that an effective communication strategy be developed that ensures the feedback between policy implementers and policymakers and that succession planning be mainstreamed in the functions of key positions.

This strategy further proposes courses, trainings and exchange programs as a response to the highlighted activities. These range from short, free online courses to graduate programs offered in universities in Europe, the United States of America among others. The short term courses are intended to address current challenges being faced in handling the VRE integration levels with courses varying from 3-5 day trainings to upto 6 month long courses. The proposed exchange programs are foreseen to offer practical learnings and benchmarking experience with organisations in countries that have VRE integration levels higher than Kenya including, Denmark, Germany, Morocco, and Uruguay. Identified organisations include utilities, system/grid operators, research institutions, and renewable energy forecasting organisations. Additionally, long-term graduate courses are intended to raise the overall skill level within the sector in light of the anticipated increase in VRE integration levels in the next 10 years. Emphasis is given to post-graduate level courses on energy planning and management, energy economics, renewable energy systems, and international energy studies among others.

This strategy includes a workplan and budget covering the duration of the 4-year program period. The workplan indicates the tentative dates for the administration and planning of the strategy, as well as a proposed schedule for the short-term courses, long-term training and exchange programs. The draft budget highlights the costs associated with the implementation of the proposed activities. The estimated total budget is € 1,188,432 across short-term (€ 63,713), long-term (€ 1,082,900) and exchange programs (€ 41,819).

For the administration of this strategy, a management structure and plan is proposed to oversee day-to-day operations during the duration of this intervention. This structure is envisioned to monitor and evaluate the effective execution of the strategy vis a vis the main and strategic objectives of the programme. In this regard, a HCD committee comprising of members of the VRE committee and a yet to be contracted HCD secretariat is proposed. This secretariat shall be overseen by a HCD board comprising of representatives from the Ministry of Energy and EPRA among others. Specific key tasks have been proposed for the board and committee in regard to execution of the strategy including developing and approval of the HCD action plan, implementation of the course and trainee selection process and, supervision of the engagement with the training institutions among others.

1 Human Capacity Development Objectives

To manage the uncertainty and variability associated with VRE, power system operators apply multiple techniques including robust plant power forecasting, load forecasting, data-driven scheduling and dispatching, and deployment of operating reserves. This Human Capacity Development (HCD) strategy builds on the outputs of the Human Capacity Gap (HCG) assessment report, which outlines the key barriers and gaps at the individual, organization, and system level in relation to VRE origination, integration, and operations. The main objective of this strategy is to enhance stakeholders' capacity and readiness for increased shares of VRE in the power system. While this strategy focuses on human capacity development, other complementary interventions are still needed to achieve this objective. These include enhancing technical system capacity, infrastructure development, research, consulting assignments, policy and planning, among others. Achieving this objective will require substantial changes to traditional power system origination, integration, and operations to support VRE management capabilities.

Recognizing the need to urgently address the current human capacity challenges, prepare for future VRE scenarios and to strengthen the planning processes for VRE origination, the main objective is cascaded down to three strategic objectives, as shown in Figure 1 below.

These are:

- Strategic objective 1: Strengthen the human capacity to manage current VRE
- Strategic objective 2: Enhance the human capacity to manage future VRE
- Strategic objective 3: Improve system-level planning processes for VRE

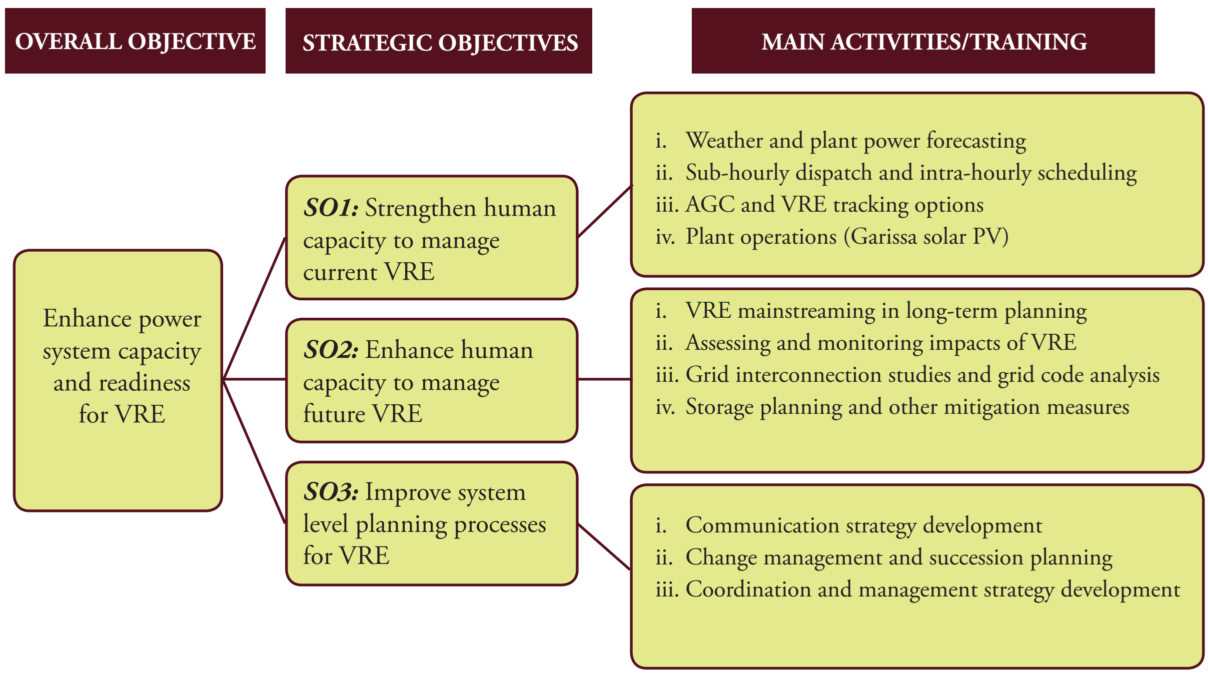


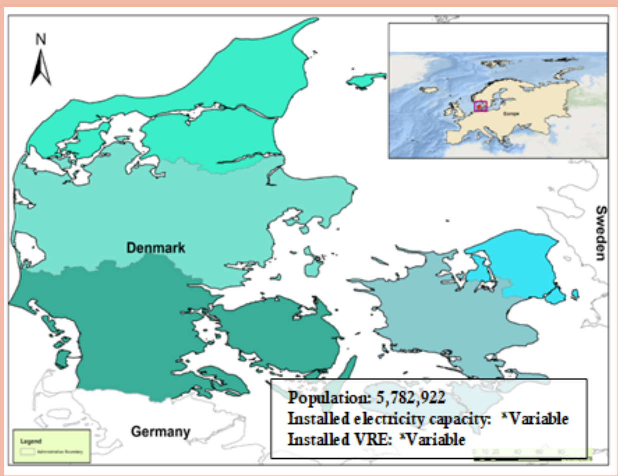
Figure 1: Summary of the Objectives and Main A ctivities

The strategic objectives are then divided into main activities or training programs, which are further divided into specific activities or training programs. Details of the training programs are provided in section 2 of this strategy.

1.1 SO 1 – Strengthen Human Capacity to Manage Current VRE

The HCG assessment characterizes the existing challenges of operating VRE on the power system. Feedback from the VRE committee meetings, the joint meetings, self-assessment surveys and case studies point to the urgent need to strengthen the infrastructure to mitigate major system disruptions. The urgency is heightened by the fact that more VRE capacity is expected in the short-term. Key institutions affected include the Kenya Meteorological Department (KMD), National System Operator (Kenya Power), and VRE power plant operators (Strathmore University, REREC, KenGen, and LTWP). The following activities are proposed to address these gaps and barriers. Due to the urgency of the need, activities proposed are either short-term training programs or exchange programs.

Case Study IV – Denmark: Efficient System Operation and Planning



Denmark is currently the world leader in wind power generation. It's market share of wind has grown to 47% in 2019 compared to 1.9% in 1990 according to the country's grid operator Energinet. Efficient operation of such a system with large share of VRE requires a high degree of flexibility in both generation and transmission. Denmark has managed to attain this through efficient system operation, policy tools and market instruments. Denmark has minimal curtailment[1] of the wind power generation unlike countries such as Spain. This is made possible by having dynamic power plants and power exchange with neighboring countries in the international electricity market.

Operational planning in Denmark is based on best available schedules and forecasts. System operation is done day-to-day, hour-to hour and minute-to-minute by the Danish Transmission System operator. The power control center makes an updated forecast of the coming period after every 5 minutes and requires all generators (greater than 10 MW) to submit update of their output every 5 minutes. To support these operational planning procedures some tailor-made IT-tools have been implemented in the control centre at Energinet. An important system is the 'Operational Planning System' which the operator uses to evaluate the predicted imbalance and decide on activation of manual reserves for up and down regulation to close as much of the gap as possible before the operating hour. The target is to minimize the remaining imbalances to be handled with expensive automatic reserves by using cheaper manual reserves for anticipative balancing. Additionally, the wind energy producers are required to produce energy according to their forecasts. Initially, wind turbine owners had no such obligations but in 2003 this was changed, and wind turbines were required to pay the costs of being out of balance (i.e., for producing more or less than what is forecast and sold in the day-ahead market). Thus, the operator of a wind farm has incentive to minimize the divergence from forecast output[2].

[1]Danish Energy Agency (2017), Integration of Wind Energy in Power Systems- A summary of Danish experiences
*Variable because of distributed energy generation and being part of the Nord pool energy market
[2]Danish Energy Agency (2015), Energy Policy Toolkit on System Integration of Wind Power. Experiences from Denmark

1.1.1 Build Capacity for Weather and Plant Power Forecasting

Weather forecasting provides the inputs to plant power forecasting. Forecasts of power output capacity distributed over a temporal scale is needed consistently and in advance to enable system operators to schedule the dispatch order. Global best practice in wind and solar power forecasting demonstrates that: service solutions are provided by an experienced forecasting provider (company or an institute); forecasting is based on multiple weather model inputs (using weighted combinations to enhance accuracy); service provider has the expertise to custom make data for different areas in the world; reliable real-time production can be provided to the system operator; and outage and curtailment information is considered in forecast planning[3]. We propose that the weather forecasting capacity be based at KMD and the plant power forecasting be centralised and led by the System Operator. Both KenGen and REREC, who plan to develop additional VRE power plants need to be exposed to forecasting principles and practices.

The HCG assessment noted plans to establish a national weather forecasting framework. The details of these plans were not readily available. This strategy recommends the training of KMD personnel in high-resolution weather forecasting with a focus on inputs for wind and solar PV plant power forecasting. Inevitably, human capacity development must be matched with access to requisite technologies that are lacking at the moment.

[3]GIZ (2015) Variable Renewable Energy Forecasting – Integration into Electricity Grids and Markets: A best practice guide, Federal Ministry for Economic Cooperation and Development.

Table 1: Specific Activities and Programs (1.1.1)

TYPE	PROPOSED COURSES (NAME/ CODE)	TARGET ORGANIZATION/S (PROPOSED STAFF NUMBERS)	SAMPLE TRAINING INSTITUTIONS
Short-Term	VRE forecasting (# ST009)	KPLC (1 – technical), KMD (2 – technical, managerial), IPPs (4 – technical), KenGen (2 – technical and managerial), REREC (2 – technical and managerial)	Imperial College London: Available free online, but participants must pay a fee to obtain a certificate. Local training sessions can be done on-site.
	Course on VRE integration (# ST010)	KPLC (3 – managerial and technical), KMD (2 - technical), IPPs (3), KenGen (2 – managerial and technical), REREC (2 – managerial and technical), KETRACO (2 – managerial and technical)	IRENA: Training can be custom-made to the trainee's needs.
	Wind energy (# ST002)	KPLC (2 – technical), IPPs (2 – managerial and technical), KenGen (2 – managerial and technical)	Technical University of Denmark (DTU): Free online course available.
Long-term	N/A	N/A	N/A
Exchange Program	Integrating forecasts and schedules from SCADA (# EP003)	KPLC (2 – technical and managerial), KMD (2), IPPs (1 – technical), KenGen (2 – technical), KETRACO (2 – technical)	Denmark, Energinet: The Danish system operator power control center makes an updated forecast of the coming period after every 5 minutes and requires all generators (greater than 10 MW) to submit an update of their output every 5 minutes. This is a higher resolution scheduling than currently at the Kenya Power NCC.
	Software for renewable energy forecasting	KPLC (2 – technical and managerial), KMD (2 - technical), IPPs (1 – technical), KenGen (2 – technical and managerial)	Denmark, ENFOR: The company provides market-leading energy forecasting and optimization solutions for the energy sector targeting utilities, energy traders, transmission and distribution system operators.

1.1.2 Enhance Capacity to Conduct Sub-Hourly Dispatch and Intra-Hourly Scheduling

Improving dispatch planning and scheduling must be accompanied by investments in equipment and accessories that will facilitate these operations. The current load forecasting process is based on an estimation process that determines the average load profile for the day ahead based on the average load profile of the respective day for the previous two weeks. This is then matched with supply forecasts provided by the generating plant operators. Scheduling and dispatch planning are also made difficult by limitations in transmission capabilities, especially to the Western Region, which then requires the System Operator to source for extra generation capacity from Uganda. Exposure and training to finer scale load forecasting will improve the management of VRE resources.

Table 2: Specific Activities and Programs (1.1.2)

TYPE	PROPOSED COURSES (NAME/ CODE)	TARGET ORGANIZATION/S (PROPOSED STAFF NUMBERS)	SAMPLE TRAINING INSTITUTIONS
Short-Term	Incorporating VRE in Electricity Grids (# ST009)	KPLC (4 – technical and managerial), KETRACO (2 – technical and managerial)	Imperial College London: Available free online, but participants must pay a fee to obtain a certificate. Local training sessions can be done on-site.
	Course on VRE integration (# ST010)	KPLC (4 – technical and managerial), KETRACO (2 – technical and managerial)	IRENA: Training can be custom-made to the trainee's needs.
	Integration of VRE power supply (#ST006)	KPLC (2 – technical), KETRACO (2 - technical)	RENAC, Berlin.
	Wind energy (# ST002)	KPLC (2), IPPs (1), KenGen (2)	Technical University of Denmark (DTU): Free online course available.
Long-term	N/A	N/A	N/A
Exchange Program	Local software solutions (# EP006)	KPLC (2 - technical), Institute of Energy Studies (2 – technical and managerial)	Uruguay, University of the Republic of Uruguay: Interactions can be through video conferences or site visits.
	Software for renewable energy forecasting	KPLC (2 – technical and managerial)	Denmark, ENFOR: The company provides market-leading energy forecasting and optimization solutions for the energy sector targeting utilities, energy traders, transmission and distribution system operators.

1.1.3 Advance Capacity in AGC and VRE Tracking Options

The National Control Centre operates a manual generation control system with controllers constantly calling station operators to adjust their output to correct for imbalances. There is a need for Automatic Generation Control (AGC), which is a self-operating system with capabilities to adjust for power output across multiple generators in response to changes in load or supply. AGC systems enable System Operators to meet the reliability criteria in a cost-effective way. This strategy is proposed to build the human capacity and exposure to approaches in AGC and VRE tracking options through the following courses.

> "There is a need for Automatic Generation Control (AGC), which is a self-operating system with capabilities to adjust for power output across multiple generators in response to changes in load or supply."

Table 3: Specific Activities and Programs (1.1.3)

TYPE	PROPOSED COURSES (NAME/ CODE)	TARGET ORGANIZATION/S (PROPOSED STAFF NUMBERS)	SAMPLE TRAINING INSTITUTIONS
Short-Term	Incorporating VRE in Electricity Grids (# ST009)	KPLC (4 – technical and managerial), KETRACO (2 technical and managerial)	Imperial College London: Available free online, but participants must pay a fee to obtain a certificate. Local training sessions can be done on-site.
	Course on VRE integration (# ST010)	KPLC (2 – technical and managerial) KETRACO (2 – technical and managerial)	IRENA: Training can be custom-made to the trainee's needs.
	Certified ReGrid® Manager (CRGM) (#ST005)	KPLC (1 – technical) KETRACO (1 – technical)	RENAC, Berlin: training on how a high amount of variable renewable energy (wind and solar) can be safely integrated into the electricity supply.
Long-term	N/A	N/A	N/A
Exchange Program	Local software solutions (# EP006)	KPLC (2 – technical), Institute of Energy Studies (2 – technical and managerial)	Uruguay, University of the Republic of Uruguay: Interactions can be through video conferences or site visits.
	Software for renewable energy forecasting	KPLC (2 – technical and managerial)	Denmark, ENFOR: The company provides market-leading energy forecasting and optimization solutions for the energy sector targeting utilities, energy traders, transmission and distribution system operators.

1.1.4 Strengthening VRE Plant Operations

Both KenGen and REREC operate VRE power plants. KenGen has plans to develop new VRE (wind) power plants which are listed in the LCPDP. REREC urgently requires expertise to operate and maintain the Garissa power plant as these activities are currently done by KenGen and the EPC contractor respectively. To fill the technical capacity gap concerning operation, it is advised that either the KenGen staff be seconded permanently to REREC to fill this role or REREC hires new staff with expertise in managing large scale solar plants. The third option is to outsource the management to a third party with the required expertise. The EPC contractor should be requested to train the REREC staff on the system configurations and basic maintenance before the end of the technical support period in November 2020. No training or exchange program is required.

1.2 SO 2 – Enhance Human Capacity to Manage Future VRE

The LCPDP envisions a future with even higher proportions of VRE capacity. With ambitions to increase VRE contribution from the current 15% to about 24% over the next 5 years, it is imperative that measures are instituted to support capacity development of the relevant human capital. The energy transition into cleaner renewable energy sources will require a re-orientation of the way planning, integration, and governance of power systems are done. According to the analysis done by the World Economic Forum in 2018, globally, human capital scores the lowest in the transition readiness scores[4]. This strategic objective aims to build the human capacity to manage a more expansive and diverse portfolio of VRE on the power system.

There is need to develop a more integrated long-term energy planning process. Lessons from the US

[4]WEF, 2018. Fostering Effective Energy Transition: A Fact-Based Framework to Support Decision-Making

demonstrate that there is merit in developing systems that go beyond demand, supply and economics of power system planning. Integrated resource planning (IRP) was borne out of financial crises in the 1970s and 1980s in the US that arose from utilities investing in expensive power plants that were not needed, and from cost overruns from nuclear power plants[5]. These cost overruns and inflated load forecasts led to the bankruptcies of several utilities. It is now a process that is mandated in 28 states in the US. The main difference between IRP and conventional least-cost power development plans is that the former accounts for the lowest present value life cycle cost that considers optimal environmental and economic costs, energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive demand-side programs. Figure 2 indicates factors missing in the least-cost generation planning that are part of IRP.

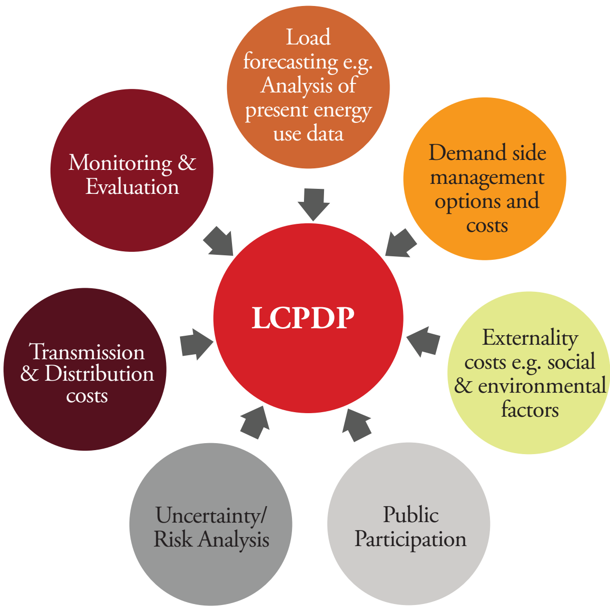


Figure 2: Integrated Power System Planning

Within the VRE development cycle, the following are areas of improvement to advance the sector's readiness to absorb more VRE:

- strengthening capacity to carry out long-term energy planning with sensitivity to impacts of VRE;
- to strengthen governance and regulation of the power sector in the implementation of energy plans;
- to enhance grid management and interconnection, support research and development in VRE;
- to strengthen VRE integration; and enhance dispatch simulation and forecasting techniques.

1.2.1 VRE Mainstreaming in Long-Term Energy Planning

For several years now, agencies under the Ministry of Energy have led long-term energy planning primarily through the LCPDP process. The HCG assessment confirms the existence of in-depth experience in long-term energy planning across the agencies but notes that there has been little to no consideration on the impacts or consequences of VRE on system operations. A clear gap exists across all the energy sector agencies as far as mainstreaming VRE into long term energy planning is concerned. The Energy Act 2019 has introduced county and integrated national energy plans that are fundamental to outlining the country's energy strategy. This strategy proposes a mix of long-term training courses and exchange programs to advance this capability. Although the majority of the current staff involved in VRE management hold a postgraduate degree, it is important to train the future crop of VRE managers.

> **"The energy transition into cleaner renewable energy sources will require a re-orientation of the way planning, integration, and governance of power systems are done."**

[5]International Rivers, 2013. An Introduction to Integrated Resources Planning

Table 4: Specific Activities and Programs (1.2.1)

TYPE	PROPOSED COURSES (NAME/ CODE)	TARGET ORGANIZATION/S (PROPOSED STAFF NUMBERS)	SAMPLE TRAINING INSTITUTIONS
Short-Term	Energy planning (# ST001)	KPLC (1 – managerial), KETRACO (1 – managerial), GDC (1 – managerial), KenGen (1 – managerial), NuPEA (1 – managerial), REREC (1 – managerial), EPRA (2 – managerial) and MoE (2 – managerial)	IRENA: Based on IRENA System Planning Test (SPLAT) models.
	Renewable energy management and project finance (# ST004)	Representatives from County Governments and MoE (Technical)	University of London: Trainers can be invited to carry out custom-made training in Nairobi or another location in Kenya.
Long-term	Masters course from # LT001, # LT002, # LT003, # LT004, LT005, # LT006 or # LT007	KPLC (2 - technical), KETRACO (2 – technical), GDC (1 - technical), KenGen (1 - technical), NuPEA (2 - technical), REREC (1 - technical), EPRA (2 technical) and MoE (3 - technical)	An objective criterion should be used to select suitable candidates and appropriate Masters courses out of the listed options.
	Master course # LT005	EPRA (1 – technical)	An objective criterion should be used to select a suitable candidate.
	Master course # LT008	KenGen (1 – technical)	An objective criterion should be used to select a suitable candidate.
Exchange Program	Complex energy planning (# EP002)	MoE (2 - managerial), EPRA (1 - managerial) and KPLC (1 - managerial), KETRACO (1 - managerial)	Germany, WEMAG: Interactions can be through video conferences or site visits.
	Country driven long-term mainstreaming of VRE (# EP005)	MoE (2 - technical), EPRA (1 – technical) and KPLC (1 – technical), KETRACO (1 – technical)	Morocco, IRESEN: Interactions can be through video conferences or site visits.

1.2.2 Assessing and Monitoring Impacts of VRE

Current operations of VRE have impacted the unit cost of electricity, ramping frequency of generators, geothermal reservoirs due to curtailment, and quality of electricity supply. The immediate, medium-term and long-term impacts on VRE integration are not well understood. The most appropriate approach would be to commission a study on these aspects, but it is also important to have the in-house capacity to carry out preliminary assessments, especially on the impacts on electricity cost.

This strategy proposes some short-term training courses for MoE and EPRA staff on these aspects. This is proposed as a precursor to an integrated effort to broadly understand the impacts of VRE on the power system. The staff trained will form part of a team that will define the scope of the undertaking and formulate the terms of reference.

Table 5: Specific Activities and Programs (1.2.2)

TYPE	PROPOSED COURSES (NAME/ CODE)	TARGET ORGANIZATION/S (PROPOSED STAFF NUMBERS)	SAMPLE TRAINING INSTITUTIONS
Short-Term	Course on VRE integration (# ST010)	MoE (2 - technical), EPRA (2 - technical) and NuPEA (1 - technical)	IRENA: Training can be custom-made to the trainee needs.
	VRE integration (# ST006)	MoE (2 - technical), EPRA (2 - technical) and NuPEA (1 - technical)	RENAC, Berlin.
Long-term	N/A	N/A	N/A
Exchange Program	N/A	N/A	N/A

The Energy Act 2019 established NuPEA, which, together with REREC, is mandated to formulate a national strategy for coordinating research in renewable energy, undertake research, development, and dissemination of appropriate renewable energy technologies. Furthermore, the agency is expected to lead the development of all human resources in the energy sector and promote energy research in the country. NuPEA already has resident experience researching nuclear energy, however, their capacity needs to be expanded rapidly. There are already ongoing processes to recruit additional staff to cover the shortfall.

1.2.3 Grid Interconnection Studies and Grid Code Analysis

With an increasing contribution to the grid of VREs, system operators and electricity regulators will need to develop standards around their integration to maintain the integrity of the power system. Currently, grid connection studies are conducted by the power generators hence introducing the risk of bias. The system operator and the regulator already have skills to develop the grid code, which has requirements for wind and PV plants. With the upcoming East Africa Power Pool, both the operator and regulator will need to be equipped to carry out and review grid connection and integration studies, respectively. The system operator should also be trained to frequently run analysis on the dynamic and steady state of the system to gauge reliability.

Table 6: Specific Activities and Programs (1.2.3)

TYPE	PROPOSED COURSES (NAME/ CODE)	TARGET ORGANIZATION/S (PROPOSED STAFF NUMBERS)	SAMPLE TRAINING INSTITUTIONS
Short-Term	Certified ReGrid® Manager (CRGM) (# ST005)	MoE (2 – technical), EPRA (2 – technical), KPLC (2 – technical) and NuPEA (1 – technical), KETRACO (2 – technical)	RENAC, Berlin.
	VRE integration (# ST006)	MoE (2 – technical), EPRA (2 – technical), KPLC (2 – technical) and NuPEA (1 – technical), KETRACO (2 – technical)	RENAC, Berlin.
Long-term	N/A	N/A	N/A
Exchange Program	N/A	N/A	N/A

1.2.4 Storage and Other Mitigating Measures

Various storage technologies exist in the market and the costs have been going down due to increasing technological innovation in this area. Some of the storage technologies include batteries (lithium ion, lead acid, electric double layer capacitors, etc), pumped hydro, flywheels, among others. Storage contributes to system flexibility in several ways, among them load shifting, balancing, and frequency regulation. Advances in energy storage mean that variable renewable sources can be used even when weather conditions are not favourable. To ensure that the country's transition to a low carbon economy fully utilizes the benefits of renewables, we will need to equip the generators such as KenGen with technical knowhow of power storage options.

Table 7: Specific Activities and Programs (1.2.4)

TYPE	PROPOSED COURSES (NAME/ CODE)	TARGET ORGANIZATION/S (PROPOSED STAFF NUMBERS)	SAMPLE TRAINING INSTITU-TIONS
Short-Term	VRE integration (# ST006)	MoE (2 – technical), EPRA (2 – technical), KPLC (2 – technical) and NuPEA (1 – technical), KETRACO (1 - technical)	RENAC, Berlin: Courses can be tailor-made to the local context.
	VRE integration (# ST007)	MoE (1 – technical), KenGen (1 - technical), REREC (1 – technical), KPLC (2 – technical), KETRACO (1 – technical)	Enhancing Capacity for Low Emission Development.
	(EC -LED): Courses can be tailor-made to the local context		
Long-term	Energy storage (# ST008)	MoE (1 – technical), KenGen (1 – technical), REREC (1 – technical), KPLC (2 – technical and managerial), KETRACO (1 – technical)	University of London.
Exchange Program	N/A	N/A	N/A

1.3 SO3 – Improve System Level Planning Processes for VRE

The HCG assessment notes that the weakest point in the VRE development process is origination. Until recently, the FiT and the LCPDP process worked independent of each other although the outputs of the two overlap significantly. Also, the political drive to deliver the Vision 2030 flagship projects influenced the intake of independent power producers. An aspect that requires addressing is the effective communication between the policy implementers on one side, and the policymakers and executive on the other side, or the failure of the policymakers and executive to follow the laid-out plans by the policy implementers, or both. There is also need for change management skills given the changes outlined in the Energy Act (2019) as well as thought leadership on succession planning and skills transfers. Organizations like KenGen have about 30% of their staff above 50 years.

1.3.1 Communication Strategy Development

The policy implementers need to develop skills that enable them to package technical content into simple messages that policymakers and the executive can appreciate and understand. Since communication is about the communicator, the message and the recipient, it is important for the policy implementer to be aware that the political economy issues and the interests that inform the political inclinations in order to better communicate in the right language but also to the right audience. Appreciating that policymakers have long

priority lists, it is important for the policy implementers to prioritize urgent and important items that require more immediate attention from the policymakers. It is also important for policy implementers to identify the overall picture of issues in addition to the specific issues. For example, the key priorities in the electricity sub sector are ensuring the quality of supply, reduced cost of electricity and stimulating demand to match supply. Matters relating to VRE should be communicated within this context to gain the attention needed.

This strategy does not propose any specific course on strategic communication training as these can be procured through local suppliers on a competitive basis. The course is suitable for technical leads in various agencies in-charge of VRE.

1.3.2 Change Management and Successions Planning

To ensure the proposed harmonised structure transitions from ad-hoc setup to being more formalized, change management and succession planning process is required. An effective succession plan involves more than just a replacement plan for the proposed power planning process and includes a comprehensive staff development system. Harmonisation and continuance of the power planning process depends in part on having identified and developed replacements/successors for key positions. Succession plans, therefore, should be: systemic (system-wide); systematic (defined processes) and; tailored (specific to individuals and based on identified organizational needs). This does not require short-term, long-term of exchange programs but external support in introducing more effective methods of managing and coordinating inter-agency planning.

1.3.3 Coordination and Management Strategy Development and Restructuring

Several committees exist within the energy sector and are directly or indirectly responsible for energy planning and development within the country. These include the Feed-in-Tariff Committee (FiT Committee) who assesses and reviews the expression of interest of project developers for small renewables in the country; the LCPDP Technical Committee who oversees the review and updating of the LCPDP; GIS Committee who is charged with the responsibility of mapping out existing energy resource potential in the country; VRE Committee who oversees the development of variable renewable energy in Kenya and the Demand Planning Committee who is tasked to come up with strategies of creating energy demand in the country. As is, these committees interact since the membership is mainly drawn from the same energy agencies and an individual can sit in more than one committee. This, however, is not the most effective form of engagement when it comes to proper planning as some agencies do not feature in all the committees given their level of specialization. For example, NuPEA is part of the LCPDP Technical Committee and not the FiT Committee. To ensure efficiency and harmonisation in the planning process, we propose that a new committee, the Power Sector Development Committee, that brings all these committees together be formed (see Figure 3 below). The existing committees then become working groups under the new committee, providing their inputs to the overall planning and energy development process. This Power Sector Development Committee can be governed by two co-chairs from the Ministry of Energy and Energy & Petroleum Regulatory Authority.

> “Since communication is about the communicator, the message and the recipient, it is important for the policy implementer to be aware that the political economy issues and the interests that inform the political inclinations in order to better communicate in the right language but also to the right audience.”

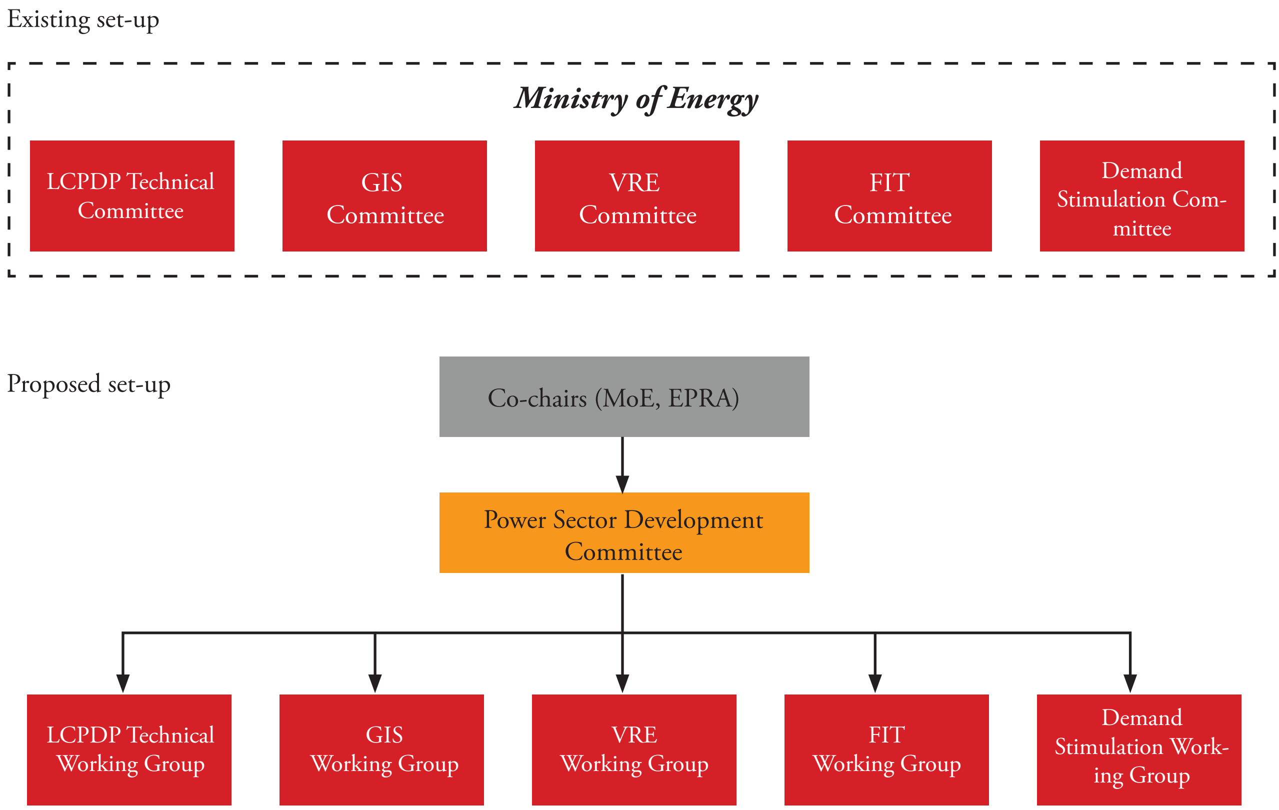
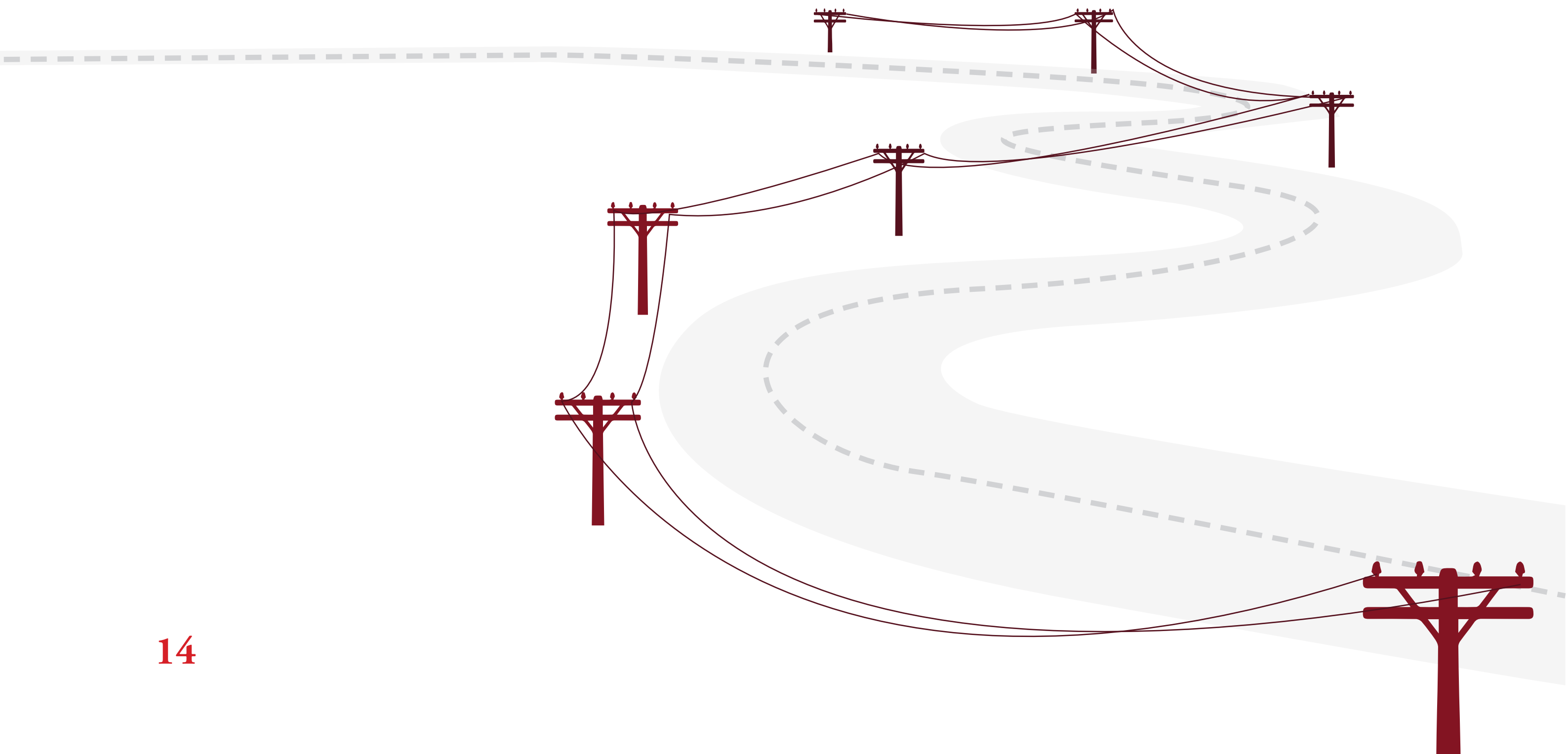


Figure 3: Existing and Proposed Organizational Structure for Energy Planning and Development

This does not require short-term, long-term or exchange programs but external support in introducing more effective methods of managing and coordinating inter-agency planning.

The majority of the staff dealing with VRE are well equipped regarding technical competencies. However, there is need to acquire some of the other soft skills that are useful in the project development cycle. These would be aimed at improving the processes involved in initiating new power projects and in their implementation and monitoring, for example, finance and negotiation skills in determining PPAs. More staff should be trained in project management, project finance, PPA structuring, monitoring and evaluation, among others.



2 Training and Capacity Building Activities

2.1 Short-Term Training

VRE DEVELOPMENT STAGE	REQUIRED SKILLS BASED ON THE SELF-ASSESSMENT	PROPOSED TRAINING/ #	SAMPLE INSTITUTIONS/ AGENCIES	RELEVANT CONTENT	COMMENTS
Origination	• Energy Resource Planning/Renewable Energy Resource Assessment • Economics of VRE • Economic and Financial Modelling • Energy Planning Software (PSSE, PSCAD, Digisilent)	Energy Planning (# ST001)	IRENA Regional Training Workshops	• Energy planning. • In Africa, training was based on IRENA System Planning Test (SPLAT) models that are regularly updated for the five regional power pools in Africa.	Similar training can be organized for the different utilities in the region to cover the other planning software.
		Wind Energy (# ST002)	Technical University of Denmark (DTU) on the Coursera online platform	• Planning for wind energy. • Wind turbine technology and aerodynamics. • Wind power density and energy production modelling. • Wind data measurement. • Financial aspects of wind project and calculating the cost of electricity from wind.	Coursera is an online platform that provides free online courses. Besides the Wind Energy Course, there are other relevant courses on renewable energy.
		Climate and Renewable Energy Finance (# ST003)	Frankfurt School of Finance and Management	• Environmental economics. • Climate finance. • Sources of financing and available instruments. • Renewable energy finance and the role of project finance. • Financial modelling and business plan preparation.	It is an online course and takes six months.
		Renewable Energy Management Project Finance Certificate (# ST004)	The European Energy Centre (The University of London)	• Introduction to renewable energy finance and sustainable design. • Methods of Financing: FiT/ RHI / ROCs / CfD / PPA / ESCO /EPC. • Project risk and financial management. • Basic project finance and technical calculations – e.g. energy, economics, emissions, NPV, IRR. • Life cycle assessment (LCA) and approach. • Incentives and barriers to Investment.	The course is available online. It is designed to take one month but can run for three months based on the speed of the student.

VRE DEVELOPMENT STAGE	REQUIRED SKILLS BASED ON THE SELF-ASSESSMENT	PROPOSED TRAINING/ #	SAMPLE INSTITUTIONS/ AGENCIES	RELEVANT CONTENT	COMMENTS
Integration	• Design of Base Stations • System Studies • Tools and Techniques in VRE integration • Energy Storage for VRE	Certified ReGrid® Manager (CRGM) - Grid integration of wind and PV (# ST005)	Renewable Academy (RENAC), Berlin	• Scenario development • Short term prediction • Generation expansion planning • Balancing power Generator concepts • Grid codes • Generation expansion planning • Grid and system integration studies • Energy storage	Online training that takes 6 months Suits engineers who wish to become experts planning and operation of electricity systems with large amounts of wind and solar power
		Integration of Variable Renewable Technology in Power Supply Systems (# ST006)	Renewable Academy (RENAC), Berlin	Covers both technical and management aspects of the VRE Management: • Wind and photovoltaics feed-in time series • Residual load approach for system planning and operation • Wind and PV short-term power forecasts for system operation • Loss of load probability and reliable generation from wind/PV • Positive and negative balancing power calculation • Grid integration strategy implementation Technical: • Photovoltaic (PV) and wind power inverter technology • Wind turbine generators types • Grid code for low, middle and high voltage grids • Frequency control • Reactive power and voltage control strategies • Monitoring and control of grid-connected generation units	Takes 3-5 days for each section Trains both individuals as well as organizations Targets Engineers
		Various RE centered trainings including VRE integration (# ST007)	Greening the Grid (supported by the U.S. Government's Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) program)	• Innovative approaches to interconnection processes, compensation mechanisms, and planning • Energy storage	This is based on previous training, but they have periodic trainings. They also have a tool kit on VRE integration and management

VRE DEVEL-OPMENT STAGE	REQUIRED SKILLS BASED ON THE SELF-ASSESSMENT	PROPOSED TRAINING/ #	SAMPLE IN-STITUTIONS/ AGENCIES	RELEVANT CONTENT	COMMENTS
Integration		Renewable Principles and Renewable Energy (# ST008)	University of Queensland	• Energy literacy, energy systems, bioenergy, geothermal, solar, wind power, hydropower, ocean power, energy storage, and electricity management.	The course lasts 12 weeks It's a free online course.
		Various courses including Energy Storage, Solar PV (# ST008)	The European Energy Centre (The University of London)	• Types of electrical energy storage and key characteristics. • Parameters for electrical energy storage. • Operational characteristics of electrical storage. • Costs and pricing. • Integration of energy storage into electrical grids. • Off-grid systems, architecture and sizing.	Various universities offer these courses.
Operations	• Energy demand and supply management • Power systems planning and analysis • Pricing of ancillary services • Power system operations and stability • VRE management (dispatch planning, voltage control and optimization, frequency) • VRE curtailment • VRE forecasting • Operating AGC and HVDC	Incorporating renewable energy in electricity grids (# ST009)	Imperial College London	• Electricity systems and traditional generation. • Operational characteristics of the main types of electricity generation technologies, including fossil fuel, nuclear and renewables. • Changes in electricity system operations due to increased penetration of variable renewables. • Technologies, measures and operating practices to cost-effectively incorporate and manage high penetrations of variable renewables. • Case studies on how different countries are managing the integration of variable renewables into their electricity systems.	It's offered for free online under the Edx learning platform, however, participants need to pay a fee to get the certification. Edx has additional courses on Renewable energy offered by different universities.

VRE DEVEL-OPMENT STAGE	REQUIRED SKILLS BASED ON THE SELF-ASSESSMENT	PROPOSED TRAINING/ #	SAMPLE IN-STITUTIONS/ AGENCIES	RELEVANT CONTENT	COMMENTS
Operations		Capacity Building Course-Variable Renewable Energy Integration in Central America (# ST010)	IRENA	Methodologies and practices for voltage control in the light of VRE Forecasting of VRE generation: • System and tools based on centralized wind power forecasting • Integration of variable renewable energy forecasting data with other tools and processes for real-time system operations in the control room: • Deterministic and probabilistic reserve planning forecast of possible future generation scenarios	Brought various stakeholders who are system operators in the Central America region Though this was focused on the North America Division, a similar training can be organized for system operators in Africa

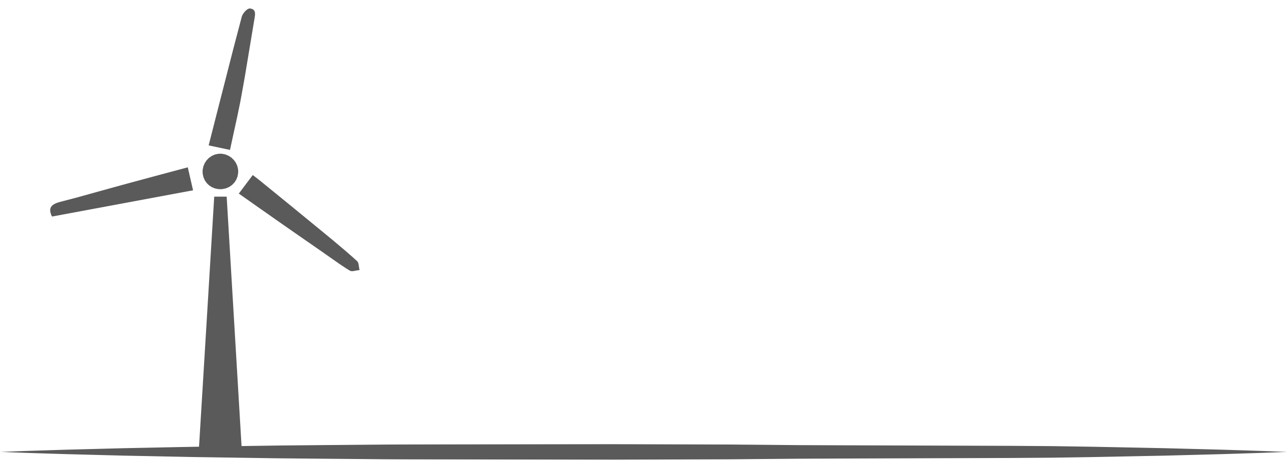
2.2 Long-term Training

COURSE/#	SAMPLE INSTITUTIONS	CONTENT
Sustainable Energy Planning and Management (# LT001)	Aalborg University, Denmark	• Energy Project Evaluation • Energy System Analysis • Theories of Science and Research Designs • The Socio-Technical Context of Planning • Sustainable Energy Policies
Postgraduate Programme Renewable Energy (# LT002)	University of Oldenburg, Germany	• Fundamentals of Renewable Energy • Energy Resources and Systems • Renewable Energy Technologies • Sustainability of Renewable Energy • Integration of RE • Renewable Energy Modelling and Simulations
Master of Engineering Studies, Renewable Energy Systems (# LT003)	Massey University, New Zealand	• International Long-Range Energy Alternatives Planning System (LEAP) model • Renewable Energy technologies (solar radiation, wind, hydro, tidal, wave and biomass systems) their design, including economics and performance • Measuring renewable energy resources, and understanding the challenges of providing energy efficiency
Master of Science, Sustainable Energy Systems (# LT004)	University of Edinburgh, United Kingdom	• Renewable Energy technologies: Wind, Solar, Marine • Renewable Energy Resource Assessment, energy production, delivery and consumption; • Sustainability; economics, policy and regulation
Master of Energy Economics (# LT005)	Rice University, United States	• Analysis of energy markets and the micro and macro impacts of various stimuli; • Quantitative skills to better utilize data to inform strategic decisions; • Factors contributing to changes in energy markets

COURSE/#	*SAMPLE INSTITUTIONS*	*CONTENT*
Master of Science in Energy Policy and Climate (# LT006)	Johns Hopkins University, United States	• Climate change science and the potential impacts of climate change in this century and beyond, energy law and policymaking, primary energy technologies, including both fossil fuel-based systems and renewable energy options.
Master of Science, International Energy Studies and Energy Finance (# LT007)	University of Dundee	• Analytical tools for energy economics. • Financial and project and analysis of natural resources and energy ventures. • Just Transition to low carbon economy. • Legal frameworks for International Project Finance.
Master of Science, Wind Energy (# LT008)	Technical University of Denmark (DTU)	• Mechanics and Aerodynamics. • Mechanics of Materials and Structures. • Testing and Measurements. • Electrical Wind Turbine Systems. • Electrical Wind Turbine Technology.

2.3 Exchange Programs

COURSE/#	*SAMPLE INSTITUTIONS*	*COMMENTS*
Germany	Energie Baden-Württemberg AG (EnBW) (# EP001)	Produce about 500 MW wind in the Baltic Sea and more in development in the North Sea.
	Wemag AG (# EP002)	A regional energy provider with several decentralized generation units in its area. It may be a good match for KETRACO.
Denmark	Energinet (# EP003)	A system operator using a DPS tool which integrates forecasts and schedules from SCADA system to inform operational planning and system control.
	ENFOR A/S (# EP004)	Offers software solutions for variable renewable energy forecasting. Potentially useful for Kenya Power.
Morocco	Institut De Recherche En Energie Solaire Et Energies Nouvelles (IRESEN) (# EP005)	Research institution developed to coordinate and enhance research in VRE integration. Potential useful lessons for NuPEA.
Uruguay	University of the Republic, Uruguay (# EP006)	They developed SimSEE, a simulation software for the local utility.
Spain	CECRE (Control Centre of Renewable Energies) (# EP007)	Control centre for monitoring Renewable Energy installations.



3 Workplan

3.1 Workplan

#	*ACTIVITIES*	*2020*				*2021*				*2022*				*2023*			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	***Administration and Planning***																
1.1	Adoption of the HCD strategy	■															
1.2	Development of HCD Action Plan	■															
1.3	Formulation of a inter-agency HCD strategy Committee and Secretariat	■															
2	***Short-Term Training***																
2.1	VRE forecasting (# ST009)																
2.2	VRE integration (# ST010)																
2.3	Wind Energy (# ST002)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
2.4	VRE integration (# ST006)																
2.5	VRE integration (# ST005)																
2.6	Energy planning (# ST001)																
2.7	RE management and finance (# ST004)																
2.8	Energy storage (# ST008)																
2.9	VRE integration (# ST007)																
3	***Long-Term Training***																
3.1	Sustainable Energy Planning and Management (# LT001)							■	■	■	■	■	■	■	■	■	
3.2	Postgraduate Programme Renewable Energy (# LT002)							■	■	■	■	■	■	■	■	■	
3.3	Master of Engineering Studies, Renewable Energy Systems (# LT 003)							■	■	■	■	■	■	■	■	■	
3.4	Master of Science, Sustainable Energy Systems (#LT 004)							■	■	■	■	■	■	■	■	■	
3.5	Master of Energy Economics (#LT 005)							■	■	■	■	■	■	■	■	■	
3.6	Master of Science in Energy Policy and Climate (# LT006)							■	■	■	■	■	■	■	■	■	
3.7	Master of Science, International Energy Studies and Energy Finance (# LT007)							■	■	■	■	■	■	■	■	■	
3.8	Master of Science, Wind Energy (# LT008)							■	■	■	■	■	■	■	■	■	
4	***Proposed Exchange Programs***																
4.1	WEMAG, Germany: (# EP002)			■						■							
4.2	Energinet, Denmark: (# EP003)			■						■							
4.3	ENFOR, Denmark: (# EP004)			■						■							
4.4	IRESEN, Morocco: (# EP005)				■												
4.5	Others (TBD)																

3.2 Budget Estimate

Estimated total budget is € 1,188,432 across short-term (€ 63,713), long-term (€ 1,082,900) and exchange programs (€ 41,819) as shown in the tables below.

Table 8: Short-Term Training Budget

TYPE	SAMPLE INSTITUTION/ COURSE/#	TARGET ORGANISATION/S	COMMENT	UNIT COST	TOTAL UNITS	TOTAL COST	TIME
Short Term	Imperial College London: VRE forecasting (# ST009)	KPLC (1), KMD (2), IPP (LTWP) (4)	Available free online, but participants must pay a fee to obtain a certificate. Local training sessions can be done on-site.	€ 45	7	€ 315	6 weeks
	IRENA: Course on VRE integration (# ST010)	KPLC (3), KMD (2), IPP (LTWP) (3), KenGen (2), REREC (2), MoE (2), EPRA (2) and NuPEA (1)	Training can be custom-made to the trainee needs.	€ 600	17	€ 10,200	3 - 5 days
	DTU: Coursera – Wind energy (# ST002)	KPLC (2) , IPP LTWP (2), KenGen (2)	Available free online, but participants must pay a fee to obtain a certificate.	€ 45	6	€ 270	5 weeks
	Imperial College London: Incorporating VRE (# ST009)	KPLC (4)	Available free online, but participants must pay a fee to obtain a certificate. Local training sessions can be done on-site.	€ 45	3	€ 135	6 weeks
	RENAC, Berlin: Integration of VRE power supply (#ST006)	KPLC (2), MoE (2), EPRA (2) and NuPEA (1)	Online Program.	€ 2,100	7	€ 14,700	6 months
	RENAC, Berlin: Certified ReGrid® Manager (CRGM) (#ST005)	KETRACO (1)	Online Program.	€ 2,100	1	€ 2,100	6 months
	University of London: Energy storage (# ST008)	MoE (1), KenGen (1), REREC (1), KPLC (2)	Trainers to be invited to carry out custom-made training in Nairobi or another location in Kenya.	€ 600	60	€ 36,000	1 week
	University of London: Renewable energy management and project finance (# ST004)	Representatives from County Governments and MoE	Trainers to be invited to carry out custom-made training in Nairobi or another location in Kenya.				
					TOTAL	***€ 63,720***	

Table 9: Long-Term Training Budget

TYPE	SAMPLE INSTITUTION/ COURSE/#	TARGET ORGANISATION/S	COMMENT	UNIT COST	TOTAL UNITS	TOTAL COST	TIME
Long-term	Masters course from # LT001, # LT002, # LT003, # LT004, or # LT007,	KPLC (2), KETRACO (1), GDC (1), KenGen (1), NuPEA (2), REREC (1), EPRA (2) and MoE (3)	An objective criterion should be used to select suitable candidates and appropriate Masters courses out of the listed options.	€ 63,700	9	€ 573,300	1 year
	Masters course #LT005, # LT006		Assuming 30% take 2-year-long courses offered in the US		4	€ 509,600	2 years
					TOTAL	€ 1,082,900	

Table 10: Exchange Program Budget

TYPE	SAMPLE INSTITUTION/ COURSE/#	TARGET ORGANISATION/S	COMMENT	UNIT COST	TOTAL UNITS	TOTAL COST	TIME
Exchange Program	Denmark, Energinet: Integrating forecasts and schedules from SCADA (# EP003)	KPLC (2), KMD (2), IPP (LTWP) (1)	N/A	€ 2,306.85	5	€ 11,534.25	5 days
	Denmark, ENFOR: Software for renewable energy forecasting						
	Uruguay, University of the Republic of Uruguay: Local software solutions (# EP006)	KPLC (2), KMD (2), IPP (LTWP) (1)	N/A	€ 2,957.50	4	$11,830.00	5 days
	Germany, WEMAG: Complex energy planning (# EP002)	KPLC (2), Institute of Energy Studies (2)	Interactions can be through video conferences or site visits	€ 2,306.85	4	$9,227.40	5 days
	Morocco, IRESEN: Country driven long-term mainstreaming of VRE (# EP005)	MoE (2), EPRA (1) and KPLC (1)	Interactions can be through video conferences or site visits	€ 2,306.85	4	$9,227.40	5 days
					TOTAL	€ 41,819.05	

4 HCD Management Plan

4.1 Management Structure

It is recommended that a HCD Board be established with the responsibility of providing overall oversight and management. Key roles will include, among others, approval of action plan, monitoring and evaluation plan, selection criteria, the sustainability of HCD actions, fairness, integrity, transparency, efficient and effective delivery. The board will also ensure that the delivery is implemented and aligned with the MoE - GIZ Power system readiness for the integration of variable renewable energies (VRE) project standard guidelines and procedures. In addition to this, the Board will set up measures to ensure that the project interventions and outcomes are eventually mainstreamed in institutional operations to ensure the sustainability of this initiative. Membership of the board will include representatives of the Ministry of Energy, EPRA, and Kenya Power.

The first meeting of the board should be held within 30 days of the start of the HCD process with an agenda of (i) electing a chairman and secretary, (ii) finalizing the Terms of Reference of the board and HCD committee, and (iii) constituting the HCD committee (or the process of selection). Following meetings will be held at regular intervals of at least once a quarter or as frequent as is necessary when required. Board decisions should be reached by consensus, but the final decision will revert to the Ministry of Energy in the event that this is not achieved. It is expected that the meetings will be more frequent during the inception months. There shall be established a HCD committee that will be in charge of implementing the recommendations of the board. Members of this committee will be from the constituent agencies in the Ministry of Energy and supported by a HCD secretariat, which shall oversee the day to day management of the process. The secretariat shall provide administrative and technical services and could be individuals recruited for the duration of the HCD process or a consulting firm.

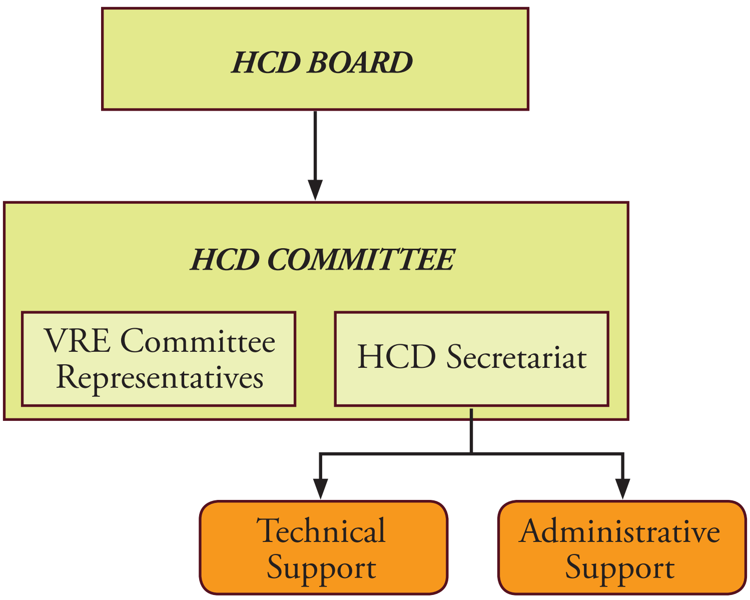


Figure 4: Proposed Management Structure

4.2 Key Tasks

The key tasks by management level are outlined in Table 11 below. It is expected that MoE will constitute the Board, which will then appoint the HCD committee. The immediate task of the HCD committee will be to develop a HCD Action Plan that builds on the proposals of this HCD Strategy. In addition to a finalized workplan and budget, the HCD Action Plan will include the course and trainee selection process and a monitoring and evaluation plan. The secretariat will provide day to day administrative and technical support to the HCD committee.

Table 11: Summary of Key Tasks

#	MANAGEMENT LEVEL	TASKS
1	Board	1. Finalize the TOR of the board and the HCD Committee 2. Constitute the HCD Committee 3. Approve the HCD Action Plan 4. Approve implementation Plan 5. Regular review of progress 6. Ensure long-term financial commitment to advance HCD activities beyond the scope of the project
2	HCD Committee	1. Develop the HCD Action Plan 2. Implement the course and trainee selection process 3. Develop detailed training curriculums for on-site training 4. Supervise the engagement with the training institutions 5. Supervise the engagement with the exchange program partners 6. Provide regular progress brief to the Board

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